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10/089,377	01/12/2004	Donald Jaffrey	A-71428/DJB/VEJ/RBE	2386

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EXAMINER	
ONEILL, KARIE AMBER	

ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/089,377	JAFFREY ET AL.	
	Examiner	Art Unit	
	Karie O'Neill	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 September 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32 and 51-57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32 and 51-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The Applicant's amendment filed on September 18, 2007, was received. Claim 1 was amended. Claims 33-50 and 58-65 have been cancelled. Therefore, Claims 1-32 and 51-57 are pending in this office action.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

3. The rejection of Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 under 35 U.S.C. 102(a) as being anticipated by Sammes (WO 99/17390), are maintained.

With regard to Claims 1, 2, 5, 7 and 8, Sammes discloses in Figures 1-3, a solid oxide tubular fuel cell assembly consisting of three layers, comprising an anode side defining a tubular passage for fuel gas, the anode side comprising a ceramic type anode layer (page 11 lines 26-27) and an anode-side current collector in electrical contact with the anode layer (page 12 lines 20- 22), a solid oxide electrolyte layer on a radially outer surface of anode layer, a cathode layer on a radially outer surface of the electrolyte layer (page 11 lines 6-18), and a cathode-side current collector on the cathode layer (page 12 lines 9-19), wherein the anode-side current collector comprises a preformed tubular metallic structure, made of nickel wire which can also be considered thread (page 12 lines 20-21) and consisting of a number of wires twisted

around each other to ensure that electrical contact takes place, the wires being twisted prior to making contact with the anode layer, therefore being preformed. The current conducting wires are embedded within the anode, allow for space for gas to pass through (page 12 lines 20-22), the wires extending substantially the full length of the tubular passage (page 12 lines 1-3) and inherently providing a reinforcing structure for the anode layer. The phrases, "formed by sintering green material" and "the anode layer is formed on", is functional language, which imparts intended use to the structural elements of the instant product claim. Therefore, while the functional language has been considered, it is given no patentable weight. While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997). A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

With regard to Claims 17 ad 19, Sammes discloses wherein the anode layer material is extruded onto the tubular metallic structure of the anode-side current collector and sintered and the electrolyte layer is provided in the anode layer by the method of slurry coating and extrusion on to the anode layer and co-extrusion with the material of the anode,layer (page 11 lines 19-23).

With regard to Claim 23, Sammes discloses wherein the cathode portion has a cathode-side current collector (page 12 lines 9-13).

With regard to Claims 28 and 29, Sammes discloses wherein the cathode-side current collector is made of a silver wire or silver paste and is adapted to permit oxygen containing gas around the assembly to contact the cathode layer (page 12 lines 9-10 and 12-13).

With regard to claims 51-53, Sammes discloses in Figures 3 and 5, a fuel cell bundle comprising a plurality of tubular fuel cell assemblies each being mechanically connected to one or more adjacent tubular fuel cell assemblies, wherein the mechanical connection is continuous along at least part of the length of the tubular fuel cell assemblies and wherein it is also intermittent along the length of the tubular fuel cell assemblies. The cell assembly made of a plurality of tubular fuel cells is placed into a base plate which extends along at least part of the length of the tubular fuel cells at the bottom of the assembly and a second plate is placed toward the top of the assembly which allows for intermittent placement of the mechanical connection (page 13 lines 10-25).

With regard to Claims 54 and 55, Sammes discloses wherein the mechanical connection is a base plate that can be made of stainless steel (page 13 line 16), which is a rigid material, and a second type of mechanical connection is a metal rod which the cells are bundled around and held in place by a wire, which is made of a flexible material (page 13 lines 21-25).

With regard to Claims 56-57, Sammes discloses wherein the mechanical connection also provides an electrical connection between the adjacent tubular fuel cell assemblies, this occurring when a number of cells are placed around a metal rod which serves as a current pick up (page 13 lines 21-23), and the connector means is made of the same material of the cathode side current collectors which is a sheet of metal (page 12 lines 12-19).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The rejection of Claims 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 above, and in further view of Dodge (WO 96/04690), are maintained. The rejection is repeated below for convenience.

Sammes discloses the tubular fuel cell assembly in paragraph 3 above, but does not disclose wherein the tubular metallic structure has surface formations thereon which project radially outwardly into the anode layer and wherein the tubular metallic structure has concave formations on a radially outer surface thereof into which the anode layer extends.

Dodge discloses in Figures 3a, 3b, 4a, and 4b, a hollow member (910) provided defining an interior space and a peripheral surface and having through-holes (912) for passing the hydrogen containing gas from the interior space to the peripheral surface, grooves (914) or concave portions being disposed on the peripheral surface in communication with the through-holes (912) that extend into the anode layers (page 11 lines 13-32). Conductive windings (916) or formations on the peripheral surface of the hollow member (910) project radially outwardly into the anode layer and form an anode (page 11 lines 34-43). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use grooves or outward projections on the anode layer of the tubular fuel cell assembly of Sammes, because Dodge teaches that these structures aid in facilitating dispersal of the hydrogen containing gas to the anode (page 11 lines 31-32).

6. The rejection of Claims 6, 9-10, 18, and 20-27 under 35 U.S.C. 103(a) as being unpatentable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 above, and in further view of Isenberg (EP 0055016 A1), are maintained. The rejection is repeated below for convenience.

Sammes discloses the tubular fuel cell assembly in paragraph 3 above, but does not disclose wherein the tubular metallic structure has a wall thickness in the range of 20 to 200 microns, comprises a support tube which is at least substantially rigid and selected from an expanded metal tube, a woven mesh tube and a perforated tube, wherein the anode layer is a nickel cermet and has a thickness in the range of about 50

to 500 microns, wherein the electrolyte layer has a thickness of less than 70 microns, wherein the cathode layer has a thickness in the range of about 30 to 100 microns and is discontinuous along the length of the assembly to provide a plurality of longitudinally spaced cathode portions and at least some of the portions are electrically connected in series and the cathode layer is discontinuous around the assembly. He also does not disclose wherein the discontinuity around the assembly is provided by at least one longitudinally-extending gap in the cathode layer and wherein the series connection of said longitudinally spaced cathode portions is provided by a strip of electrically conductive material in said gap and the strip is formed of that same material as the cathode current collector.

With regard to Claims 6, 18, 20-21, Isenberg discloses an annular fuel cell configured so that a gaseous fuel us directed axially over the outside of the cell and the oxidant flows through the inside of the cell. However, it is recognized that the location of the reactant fuel and oxidant can be interchanged such that air flows about the cells and the fuel flows within the cells (page 6 lines 5-16). Isenberg also discloses wherein the tubular metallic structure or interconnection has a wall thickness in the range of 20 to 50 microns (page 7 lines 9-11), wherein the anode layer is nickel cermet and has a thickness of about 50 microns (page 7 line 20), wherein the electrolyte layer has a thickness of approximately 20 to 50 microns (page 6 lines 35-37), and wherein the cathode layer has a thickness of approximately 50 to 500 microns (page 6 lines 23-25). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use and anode, cathode and electrolyte layer with specific thicknesses in

the assembly of Sammes, because Isenberg teaches preserving the structural integrity of the fuel cell assembly by using specified thicknesses of materials in order to provide a desired system voltage (page 5 lines 25-37).

With regard to Claims 9-10, Isenberg discloses wherein the tubular metallic structure comprises a support tube, which is at least substantially rigid and formed of a porous wall (page 6 lines 17-23). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a rigid material or porous structure for the assembly of Sammes, because Isenberg teaches the support tube providing structural integrity to the assembly system (page 6 lines 18-19).

With regard to Claims 22-25, Isenberg discloses in Figure 4, wherein the cathode layer (when the system has been reversed into an inverted cell structure) is discontinuous along the length of the assembly to provide a plurality of longitudinally spaced cathode portions (60) and the spaced portions are electrically connected in series by an elongated metal felt, metal strip or metallized inlay which acts as a current collector (page 4 lines 6-23). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use discontinuous cathode portions electrically connected in series for the assembly of Sammes, because Isenberg teaches that the segmentation alleviates circulating currents within the electrodes which tend to result from simultaneous exposure to rich and depleted reactants over the electrode surface (page 8 lines 11-28).

With regard to Claims 26 and 27, Isenberg discloses in Figure 2, wherein the cathode layer is discontinuous around the assembly and the discontinuity is provided by

at least one longitudinally extending gap in the cathode layer and wherein the series connection is provided by a strip of electrically conductive material in said gap, called an interconnection (34) and comprised of the same material as the anode, but when the cell is in an inverted structure would be coated in the cathode material (page 7 lines 16-34). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a discontinuous cathode layer with an electrically conducting strip with the assembly of Sammes, because Isenberg teaches using an electrically conductive material which remains conductive in both an oxidant and fuel environment, provides a gas-tight interconnection between the cells (page 7 lines 6-13) and insures a large contact surface to avoid potential structural damage to the outer electrodes (page 9 lines 1-3).

7. The rejection of Claims 9-16 under 35 U.S.C. 103(a) as being unpatentable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 above, and in further view of Will (US 4,347,429), are maintained. The rejection is repeated below for convenience.

Sammes discloses the tubular fuel cell assembly in paragraph 3 above, but does not disclose wherein the support tube is formed of nickel or nickel alloy, comprises a substrate of heat resistant, heat conducting metal and a nickel or nickel alloy surface layer, wherein the substrate is steel, the surface layer is a foil or is coated on the substrate, wherein a thermally conductive tube liner is provided in the passage for conducting heat therefrom, and the tube liner is tubular.

With regard to Claims 9-14, Will discloses in Figure 5, a perforated metallic substrate made of a rigid steel or stainless steel, coated with nickel (column 3 lines 13-22). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a metal coated with nickel as the support tube of the assembly of Sammes, because Will teaches these materials being electrochemically reversibly oxidized and reduced in response to AC current flow therethrough (column 2 lines 53-55).

With regard to Claims 15-16, Will discloses wherein a thermally conductive tube liner is provided in the passage which defines a space to which the electrolyte is heated by conventional means (column 2 lines 43-47) and the liner is tubular or cylindrical (column 4 lines 1-34). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a tube liner with the assembly of Sammes, because Will teaches using this structure of the mechanical strength and current carrying capacity do not require a thicker or solid support tube (column 4 lines 1-9).

8. The rejection of Claims 30-32 under 35 U.S.C. 103(a) as being unpatentable over Sammes (WO 99/17390), as applied to Claims 1-2, 5, 7-8, 17, 19, 28-29, and 51-57 above, and in further view of Goodenough (US 6,004,688), are mainatined. The rejection is repeated below for convenience.

Sammes discloses the tubular fuel cell assembly in paragraph 3 above, but does not disclose wherein the cathode-side current collector comprises at least one mesh

deposited on the cathode layer, wherein the at least one mesh is screen-printed on the cathode layer and has a thickness in the range of about 20-100 microns.

Goodenough discloses a platinum mesh with platinum leads and an electrode paste being screen-printed on top of each electrode to act as a current collector over an effective area of 2.5 cm2 (column 3 lines 32-43). Therefore, at the time of the invention it would have been obvious to one of ordinary skill in the art to use a mesh screen-printed on to the cathode layer of Sammes, because Goodenough teaches mesh being able to achieve good contact the electrode (column 3 line 43). Goodenough does not disclose the thickness of the collector, but does disclose the effective area of the collector and thickness of the electrolyte. Therefore, it would have been within the skill of the ordinary artisan to adjust the thickness of the collector as long as the mechanical strength requirements can be met. Discovery of an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272,205 USPQ 215 (CCPA 1980).

Response to Arguments

9. Applicant's arguments filed September 18, 2007, have been fully considered but they are not persuasive.

Applicant's principal arguments are:

(a) Applicant submits that there is no suggestion in Sammes (WO 99/17390) of at least partly embedding the tubular metallic structure in the anode layer as required by original Claim 1, let alone of preforming the tubular metallic structure and forming

the anode layer on it such that the tubular metallic structure becomes at least partly embedded in the anode layer and reinforced the anode layer.

(b) Applicant argues that each of the secondary references, Dodge (WO 96/04690), Isenberg (EP 00/55016 A1), Will (US 4,347,429) and Goodenough (US 6,004,688), respectively, do not cure the defects of Sammes (WO 99/17390).

In response to Applicant's arguments, please consider the following comments:

(a) The word embedded, by definition, is to cause to be an integral part of a surrounding whole and to be or become fixed or incorporated to a surrounding mass. The Sammes reference teaches the that the anode-side current collector comprises a metallic structure, made of nickel wire consisting of a number of wires twisted around each other to ensure that electrical contact takes place, the wires being twisted prior to making contact with the anode layer (page 12 lines 20-22). The wires are surrounded by the anode layer, therefore, embedding the wire into the anode layer. If two flat surface layers were sintered one on top of the other, it could be surmised that the two layers would not be embedded into one another. However, two tubular or curved surfaces making contact with one another would cause some form of embedding to take place, unless each of the curved surfaces had the exact same surface curvature and laid directly upon one another. In Sammes, the current collector is formed from a number of twisted wires that are surrounded by a tubular anode layer, both having difference surface curvatures. The terms "performing" and "forming" are considered functional language and impart intended use to the

structural features of the claim. Therefore, these terms have been considered but are given no patentable weight.

(b) Sammes discloses the limitations of independent Claim 1, including the current collector being at least partly embedded in the anode layer. The secondary references used are not to cure the defects of Claim 1 and each provide a proper explanation for the subject matter which it provides a rejection for.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karie O'Neill whose telephone number is (571) 272-

8614. The examiner can normally be reached on Monday through Friday from 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Karie O'Neill
Examiner
Art Unit 1795

MARK RUTHKOSKY
PRIMARY EXAMINER

11-19-07

KAO